mates

Maritime Alliance for fostering the European Blue Economy through a Marine Technology Skilling Strategy

Co-funded by the Erasmus+ Programme of the European Union

Highlights of MATES Pilot Experiences

Maritime on the Loop of OceanLiteracy (MOL^2)

Layman Report

November 2021

About this Report

This document was developed through the EC-funded Erasmus+ project **MATES: Maritime Alliance for fostering the European Blue Economy through a Marine Technology Skilling Strategy.**

The objective of the MATES project is to develop a skills strategy that addresses the main drivers of change in the maritime industries, in particular shipbuilding and offshore renewable energy. Both sectors are strongly linked and require new capacities to succeed in an increasingly digital, green and knowledge- driven economy.

Duration: January 2018 – April 2022 (52 months)

More information on the project is available at projectmates.eu.

Document information	
Short description	Summary of the results of the Pilot Experience MOL^2, including the successful extension of its impact to other regional, national and international interested bodies. The main achievements and European added value are clearly outlined to promote further implementation among interested experts and stakeholders.
Next steps	These results present a solid foundation for the Maritime Technologies Skills Strategy and the long-term Action Plan and sustainability.
Work Package	WP4. Pilot Experiences
Task	4.5 Impact assessment
Deliverable	4.2 Layman report
Dissemination level	Public / Project Website
MATES website link	projectmates.eu/pilotexperience/mol2
Lead authors	Susana Bastón, Amaya Soto & Lucía Fraga
Contributors	Greta Valente, Costantino Comidis, Olivia Daly & Sive Finlay
Credits	Developed and designed by AquaTT, images © project partners
Submission date	November 2021

Please cite this publication as: Baston S., Soto A., Valente G., Fraga L. (2021). Layman report of the Pilot Experience "Maritime on the Loop of Ocean Literacy (MOL^2)". MATES project.

mates
www.projectmates.eu

Co-funded by the Erasmus+ Programme of the European Union

Contents

Partners involved

Additional Collaborators:

1. Context

MATES: Maritime Alliance for fostering the European Blue Economy through a Marine Technology Skilling Strategy is an EC-funded, ERASMUS+ project whose objective is to develop a skills strategy that addresses the main drivers of change in the maritime industries, in particular shipbuilding and offshore renewable energy.

The MATES Pilot Experiences are vital components of the strategic design of the project. They consist of a series of activities that fall in line with the priority areas needed to support training and development of the shipbuilding and offshore renewable energy industries. This report summarises the outcomes and learning elements from one of these Pilot Experiences: *Maritime on the Loop of Ocean Literacy (MOL²).*

Target beneficiaries include students, teachers, trainers, skilled workers and those who have recently joined the workforce. The outcomes of the Pilot Experiences provide indispensable knowhow for bridging the maritime skills gap and increasing both sectors' overall competitiveness and attractiveness. The insights gained from these activities feed directly into the long-term MATES Action Plan, which contains policy recommendations and best practices.

Results from these Pilot Experiences are particularly relevant for the following stakeholder groups:

- **Local Government in charge of education**
- **Industry**
- **Research and Development Centres/Universities**
- **Vocational and Educational Training (VET) Centres**
- **Secondary Schools**

Transitioning to a Blue Economy is a key priority for the European Union[1]. However, many EU citizens and in particular younger groups, still do not know very much about fundamental aspects of the ocean nor about the many professional opportunities associated with the Blue Economy[2].

In this context, the term Ocean Literacy has a good deal of importance: it refers to individuals' understanding of the ocean's influence on them, and their own influence on the ocean. This concept, originally coined in the United States only in 2001, was not addressed by European projects until 2011[3]. An ocean-literate person understands the importance of the ocean to humankind; is able to communicate about the ocean in a meaningful way; and perhaps most important of all, can make informed and responsible decisions regarding the ocean and its resources[4]. Thus, developing Ocean Literacy knowledge is a vital way to help citizens to appreciate the ocean's environmental importance, as well as our relationship with the ocean, and how the ocean is adversely affected by negative, man-made impacts.

Non-formal marine science education at primary school has proved to be a successful way of increasing children's knowledge about Ocean Literacy[5]. Within this context, there is evidence that directly involving young people in activities linked to the maritime sector and encouraging them to be good stewards of the marine environment will help them, not only to develop their Ocean Literacy skills but will also raise awareness and provide knowledge on blue careers.

[1] Developing a sustainable blue economy in the European Union, European Commission – ec.europa.eu/commission/presscorner/detail/en/ip_21_2341

[2] R. M. Fernández Otero, G. A. Bayliss-Brown, and M. Papathanassiou, Ocean Literacy and Knowledge Transfer Synergies in Support of a Sustainable Blue Economy, Front. Mar. Sci., vol. 0, 2019, DOI: 10.3389/fmars.2019.00646

[3] Ocean Literacy Europe, May 14, 2015. oceanliteracy.eu

[4] Cava, F., Schoedinger, S., Strang, C., & Tuddenham, P. (2005). Science content and standards for ocean literacy: A report on ocean literacy. *Retrieved March, 25*, 2015

[5] M. Mokos, G. Realdon, y I. Zubak Čižmek, How to Increase Ocean Literacy for Future Ocean Sustainability? The Influence of Non-Formal Marine Science Education, Sustainability, vol. 12, nº 24, p. 10647, 202

Whilst the value of experiential learning in an Ocean Literacy context has not been explicitly assessed to date, such forms of learning and connecting are known to improve knowledge and skills, and to facilitate opportunities for young people to develop positive connections and attitudes towards ocean environments[6,7].

2. Overview of the MOL²

The purpose of the MOL² (Maritime on the Loop of Ocean Literacy) Pilot Experience was **to improve young peoples' Ocean Literacy by increasing their understanding and awareness of the marine environment and related industries.** The initiative promoted youth involvement in marine protection by making them reflect on the best ways to reduce their environmental impact in the ocean and by providing tools to help them to make informed and responsible decisions regarding the ocean and its resources.

The main objective of MOL² was therefore to **develop educational and training methods focused on real industry-relevant skills, which would be suitable for younger audiences.**

Specific objectives of MOL² were to:

- **Introduce marine industries and related employment opportunities to teenagers.**
- **Provide short courses on maritime technologies to students, while encouraging industry involvement in the training programmes.**
- **Promote careers for women in STEAM (Science, Technology Engineering, Arts and Maths).**

The initiative, conducted in two quite separate locations: Galicia (Spain) and Trieste (Italy), piloted two ways of approaching secondary school students and teachers to promote Ocean Literacy and the technologies and skills linked to the maritime sector. In Spain, technical workshops were conducted as part of a larger competitive raft-racing event. Meanwhile, in Italy, industry partners conducted classroom visits to engage students with practical examples of some of the professional opportunities available in maritime careers.

This report outlines the approach taken in each case study and summarises learning outcomes that can be applied to other contexts such as different settings and geographic locations.

2.1. MOL² (Spain)

The MOL² (Spain) pilot was conducted with the purpose of supporting the *Regata Solar*[8]: an annual raft building competition based in Galicia, Spain, organised by *Marine Instruments Ltd*[9]., a maritime technical company that develops and manufactures electronic equipment. Teams entering the regatta have to build a radio-controlled electric vehicle powered only by solar energy. Teams develop their entries throughout the academic year and the competition takes place at the end of June. There are three prizes based on the efficiency, performance and design of the raft. The winning team receives a 3D printer for their school.

The regatta provides a good opportunity to challenge students' skills. However, success is largely dependent on the level of commitment and engagement of their respective Technology teachers. The media lab *A Industriosa*[10] provides some technical support to the teams but this is limited and participants usually find the project quite demanding.

Teams entering the IV Regata Solar in Galicia (Spain) in 2019 getting ready for the competition. © Fundación CETMAR

CETMAR identified an opportunity in this context to provide both Ocean Literacy education and

[6] K. Dubickas y A. Ilich, Becoming an ocean advocate through experiential learning, Oceanography, vol. 34, n. 4, pp. 10-11, 2021
[7] R. Kelly et al., Connecting to the oceans: supporting ocean literacy and public engagement, Rev. Fish Biol. Fish., pp. 1- 21, 2021
[8] regatasolar.org
[9] marineinstruments.es
[10] aindustriosa.org is based on the idea of MIT Media Lab: cbsnews.com/news/mit-media-lab-making-ideas-into-reality-future-factory

practical skills training to secondary school teachers and students in a fun and engaging way. From January to April 2020, the CETMAR team conducted six workshops with regatta participants covering topics such as management of priorities, CAD and 3D printing, boatbuilding with polyester, wood and bamboo, as well as electronics, remote control and telemetry. Most of them were held before the COVID-19 lockdown and therefore were classroom-based. Only the final workshop had to be adapted to an online format.

All teams registered for the 2020 edition of the Regata Solar were invited to participate in these workshops. This project-based extra-curricular activity encouraged students to take an interest in technology and renewable energy at the same time as improving their awareness and concern for the marine environment.

OUTCOMES

- **The *Regata Solar* Terms of Reference (TOR) for the design award were reviewed in view of the implementation of this training. These now take into consideration not only the aesthetic design of the rafts as in previous competitions, but also the technologies and a circular economy approach to be used in the design and the building process. *The TOR also took into consideration the materials used, waste management, or the carbon footprint reduction of each project, in line with the sustainable development goals*[11].**
- **Due to COVID-19 restrictions, both the 2020 and 2021 *Regata Solar* competitions were cancelled. Nevertheless, the feedback from teachers and students who attended CETMAR's workshops was positive (Figure 1). More than 90% of the responses agreed that the training had been useful for improving the skills needed for the competition, and that these skills can also be applied in other contexts. Moreover, 77% stated that they had improved their Ocean Literacy.**

Left: Secondary school teachers at A Aixola registering for the MOL² training. Right: Wood working workshop. © Fundacion CETMAR

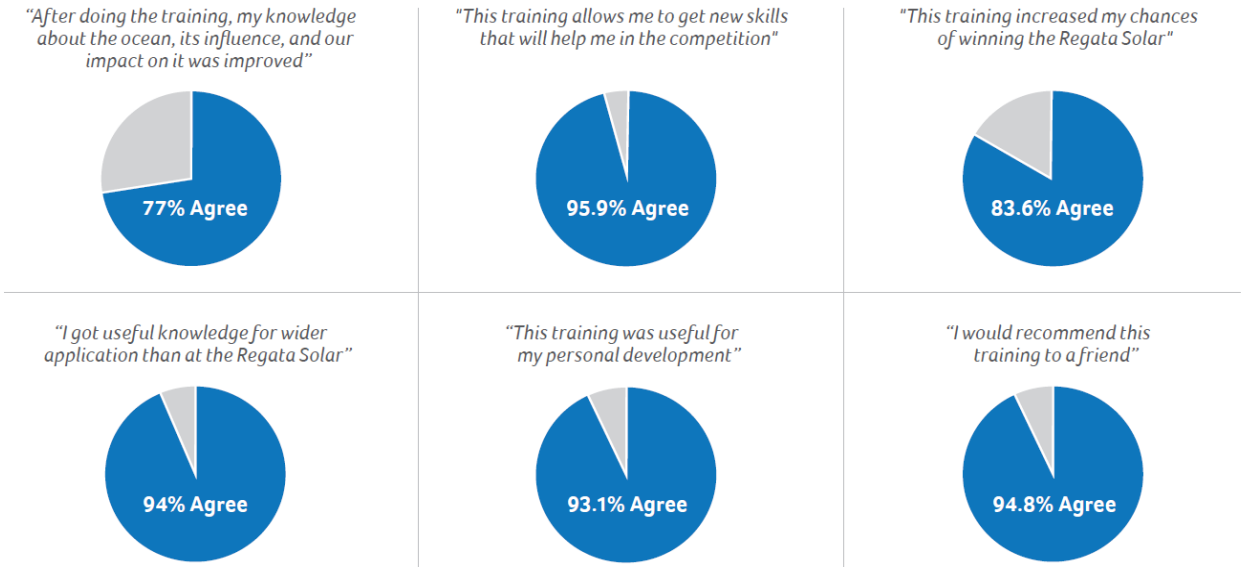


Figure 1: *Survey responses from attendees of the Galician workshops. Total of 46 answers (21 teachers and 25 students).*

[11] undp.org/sustainable-development-goals

2.2. MOL² (Italy)

The objective of MOL² (Italy) was to engage final year high school students with the digital technologies used in the shipbuilding and maritime sectors. The workshop was held at Istituto Nautico Tomaso di Savoia, Naval School of Trieste in February 2020. In October 2020, four Trieste secondary schools were interested in undertaking the industry-led sessions. Unfortunately, due to the COVID-19 lockdown, distance learning was in operation in all secondary schools, which made it impossible to undertake the Ocean Literacy and 3D scanning activities. Thus, in November 2021, a second edition of the Pilot Experience was held at Liceo Scientifico G. Galilei, a scientific secondary school, with a curriculum focused on STEAM-related subjects, and at the Istituto Tecnico A. Volta.

The workshop covered an introduction to Ocean Literacy and an overview of 3D scanning. It was conducted during three-hour sessions held in two classrooms of about 25 students each. Knowledge of 3D scanning is a skill in high demand in the job market. Therefore, the MOL² activities made a significant contribution to aligning students' skills with industry demands.

The workshop took place over two consecutive days:

- **Day 1** focused on the importance of measuring objects. The workshop explained why accurate measurements are important in marine engineering and shipbuilding and introduced photogrammetry. 3D laser scanning and a photographic survey of an object were carried out during a practical session.

- **Day 2** saw students compare outputs from the 3D laser scanning and photographic survey. Workshop leaders also demonstrated how to obtain 3D models from an inflatable object using open-source software. The concept of Ocean Literacy was introduced to the students through a presentation with the aim of raising the students' awareness of their impact on the ocean as well as the ocean's impact on them. Finally, the students viewed footage of a vessel's Bulk Carrier Engine Room and funnel 3D survey to gain a new perspective and to see the real day-to-day work that naval companies carry out.

Explaining Ocean Literacy principles to secondary school students in Trieste, Italy. © Cosnav Engineering

OUTCOMES

- As a result of the Trieste workshops, three students from the Istituto Nautico Tomaso di Savoia completed a two-week internship at COSNAV's premises where they worked on 3D scanning and green technologies as applied to shipbuilding.
- During the summer of 2020, COSNAV also hosted three students from Accademia Nautica dell'Adriatico who worked in the areas of Ocean Literacy and 3D scanning. This school is also interested in replicating the same industry-led training for students enrolled both in first and in second years.
- This training, with the curriculum available on the Marine Training platform[12], was provided to eight schools.
- Trieste is strategically placed close to Slovenia and Croatia. Therefore, cross-border links have been developed between Italy and Slovenia within the framework of this Pilot Experience, and the Pilot Experience's curriculum has now been translated into Slovenian.
- Student responses to a survey about their experience of the training were very positive (Figure 2). 93% learned about Ocean Literacy with 60% interested in learning more about the principles.

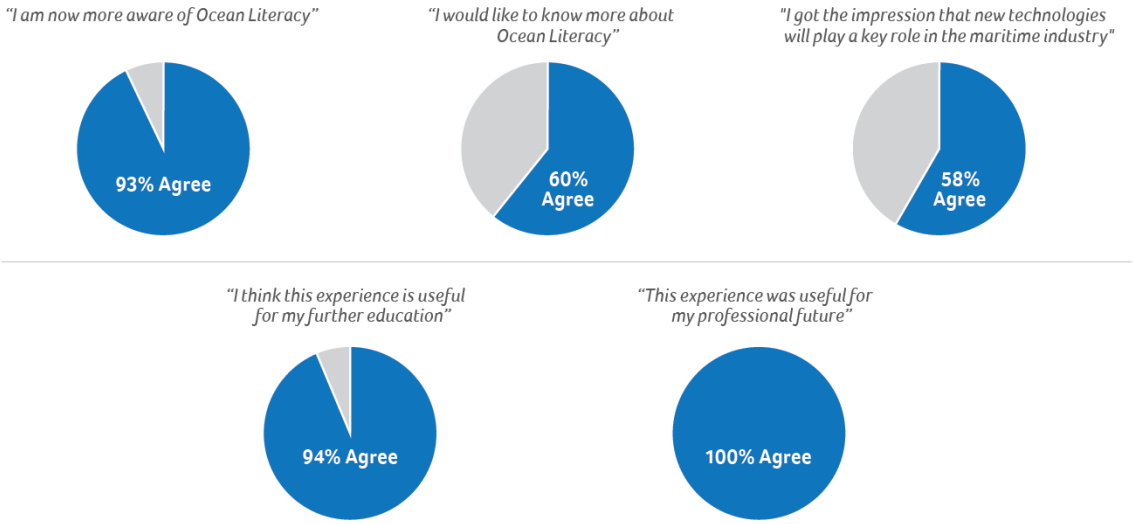


Figure 2: *Summary of the 50 survey responses from students in Trieste.*

Summary of Participants Engaged in MOL²

Location	Galicia (Spain)	Trieste (Italy)
Hours of Training	**48**	**6**
Participants	**76** (24 teachers + 52 students)	**50 students** (+ 60 more expected)
Schools reached	**23**	**8**

[12] marinetraining.eu/node/3197

3. Achievements

The MOL² Pilot Experience created a framework which enables many groups in different geographic locations to design similar activities. Here we outline the materials available and their main impact.

3.1. Results: Education and Training Materials

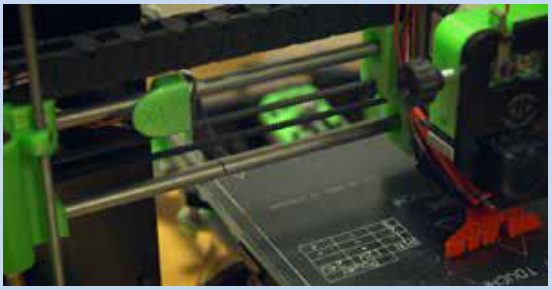
The MOL² Pilot Experience produced valuable training materials that can be adapted and applied in other contexts. These materials[13] include:

Six video tutorials addressing capacity building to develop engineering projects in the boatbuilding area

MOL² Training: Priority Management

Learning outcomes

Participants learned how to use tools and to have an integrated and complete vision of their project, to **identify** their priorities, **determine** SMART objectives, and **develop** a roadmap for meeting their goals.



MOL² Training: Free CAD and 3D printing

Learning outcomes

Participants learned the basic rules for **designing** small items for their raft, using the **Free CAD environment** and its main configuration parameters, and **detailed instructions to design a boat.** They used **Ultimate Cure software** to **3D print** their designs, including troubleshooting common faults.

MOL² Training: Polyester Modelling

Learning outcomes

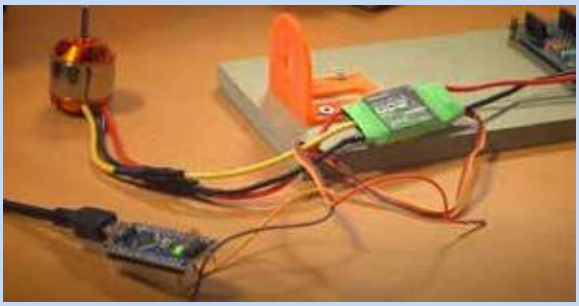
Participants learned to safely **use composites** and fiberglass-reinforced polyester sheets. They **made** polyester pastes with a resin base, **created** a flat piece in fiberglass-reinforced polyester, and **applied the pastes** to a model.

MOL² Training: Wood Gluing

Learning outcomes

Participants learned **wood gluing techniques** for boatbuilding, including gluing a single direction rib and a multidirectional lining, **understanding** the benefits that each system can provide.

[13] projectmates.eu/pilotexperience/mol2/



MOL² Training: Uses of Bamboo

Learning outcomes

Participants **learned** the characteristics of bamboo for raft-building, and **practiced cutting, joins and curving** techniques**.**

MOL² Training: Electronics and Telemetry

Learning outcomes

Participants **learned the theoretical basis** of electronics and remote frequency controls. They **replicated** a programming task applied to a craft's remote control.

Slideshow about Ocean Literacy and a guideline for companies to contact education centres

Ocean Literacy and the Maritime Industry of Tomorrow

Learning outcomes

Students **learned** the fundamental principles of Ocean Literacy and identified its links with the maritime industry. They **followed** an example of the implementation of Ocean Literacy within the design cycle using new technologies.

Protocol for replicating the industry-led talks in secondary schools

Learning outcomes

Other companies might benefit of this protocol to follow the steps to establish links with secondary schools.

3.2. Impact

3.2.1. The Competition Model (MOL² Spain)

- A competition model is an opportunity to teach STEAM subjects in a fun and informal way, and for participants to gain soft skills, such as leadership and team working.

- Running or sponsoring competitions is a good marketing strategy for companies, allowing them to gain more visibility among a wide audience, and attract younger talent.

- These competitions could serve different purposes such as to create linkages between schools, VET centres and industry; or to develop networking opportunities and pathways for student graduates into marine related careers, ensuring alignment of the training offer and the skills demand.

Even though the target audience of this Pilot Experience was secondary school students and teachers, it attracted interest from the University of Vigo. Four students from the Telecommunications Engineering programme developed a project which simulated the raft behaviour of the winning raft in the 2019 Regata

Solar competition. Since the competitive event was cancelled for two consecutive years, comparing the number of registered teams, or gaining feedback from team members about their performance has not been possible. Nevertheless, two media labs showed interest in the Experience: AmigusLab[14] requested to follow the training when possible, and FablabMallorca[15] showed interest in having a second round of the Regata Solar in Mallorca. Interest in the initiative also came from as far afield as South America, where La Fundación Educativa Tecnológica Bilingüe (FUNDETEB)[16] is organising the first Regata Solar in Colombia.

3.2.2. Video Tutorials (MOL² Spain)

MOL² video tutorials were conducted and recorded in Spanish, with English subtitles available for all recordings. The files with text in English are available for translation into other languages. Figure 3 shows the total number of views for each video.

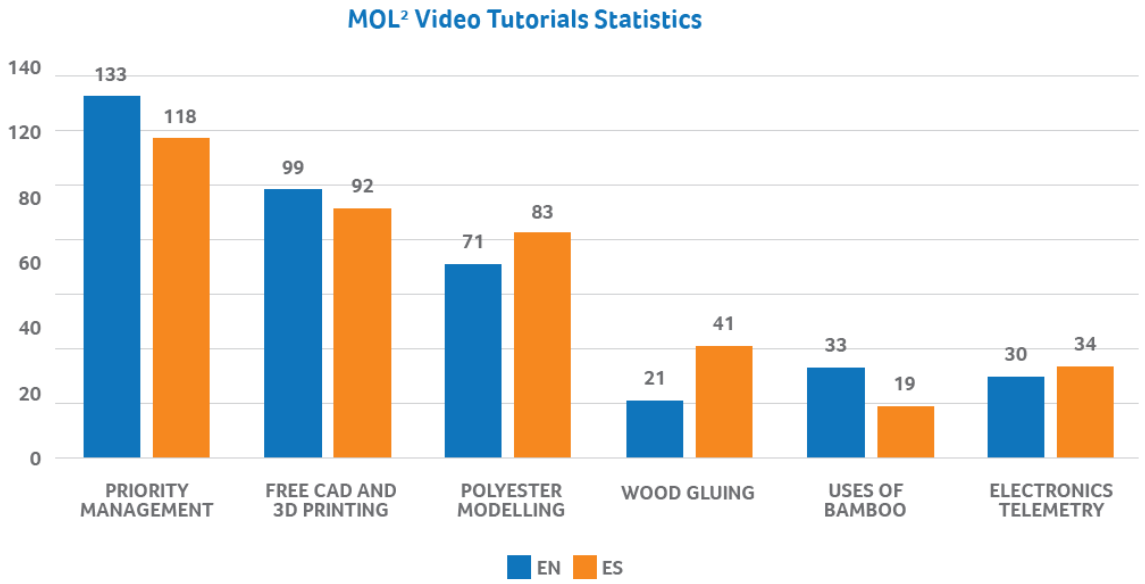


Figure 3: *Number of views of the video tutorials from publication date (from April-August 2020 for the three videos on the left and from April-June 2021 for the three on the right) to November 2021.*

3.2.3. Industry-led Talks in Classrooms (MOL² Italy)

The innovative approach of this Pilot Experience was to introduce the Ocean Literacy principles together with more technical content. However, positive feedback was received about holding workshops jointly for teachers and students in both the Spanish and Italian activities.

All schools where industry-led talks were offered were interested in their implementation, and further interest has been expressed in Slovenia and Croatia.

Two entities collaborated in the implementation of this initiative: the company STUDIO BLIZNAKOFF[17], based in Trieste, and MareFVG[18]), the Maritime Technology Cluster in the Friuli Venezia Giulia region.

[14] Amigus amiguslabs.org/Lab
[15] FablabMallo fablabmallorca.com/rca
[16] fundeteb.co
[17] blizstudio.com
[18] marefvg.it/it

4. European Added Value

The goal of the MOL² Pilot Experience was to provide informal education focused on Ocean Literacy and skills related to the maritime sector. By trialling the initiative in Spain and Italy, countries with strong connections to the sea but where Ocean Literacy has not yet been widely developed, MOL² has provided us with insights that can be applied to a wide range of stakeholders and settings. Two different approaches were undertaken in this Pilot Experience to promote Ocean Literacy among young people: a) as an extracurricular activity and b) in collaboration with the school staff and held within the ordinary school timetable.

The case studies presented here highlight the Europe-wide need to get young people to engage with maritime industries and technologies. The results demonstrated the **added value of enhancing relationships between industry and education.** Teachers from the secondary schools involved in this Pilot Experience stressed the benefits of this short interaction between industry and education centres.

While MOL² follows the European Council's Recommendation on Key Competences for Lifelong Learning (LLL)[19], particularly in the areas of climate change, sustainability, technology and digital competences, this kind of learning experience also helps to develop interpersonal and transversal skills. It is in line with other Erasmus+ funded projects such as Boat4schools[20].

This Pilot Experience promotes LLL at a European level to raise awareness of Ocean Literacy. The activities in Spain, though held in Vigo, reached out to and attracted a national audience of participants, and the video tutorials also had an international impact. In Italy, while the physical activities were held in Trieste, dissemination of these activities also impacted internationally on neighbouring countries Croatia and Slovenia.

For those interested in replicating these activities in a different context, it is recommended to take the following key learning elements into consideration:

1. **Engage with stakeholders:** Hosting the Spanish workshops in collaboration with an existing, informal event (Regata Solar) helped to reach new audiences.
2. **Work with industry collaborators:** To develop the workshop materials and ensure their relevance to industry, the MOL2 teams engaged with five external industrial contributors (three in Galicia, and two in Trieste).
3. **Take a flexible approach:** The undoubted success of these two Pilot Experience exemplars clearly shows that similar content can be presented in different formal and informal education settings.
4. **Open the workshops to teachers:** They can provide a multiplier effect by gaining an experience that can be passed on to students year after year.
5. **Record the workshops and deliver them in a video format:** This enables organisers to reach more participants. In Spain, the Regata Solar organisers received renewed interest in replicating the competition at national and international levels thanks to the MOL2 training tutorials that were shared on YouTube.

Additional recommendations for specific stakeholder groups	
Local Government in charge of education	Encourage secondary and higher education centres to engage in informal education opportunities which can help students to learn and think outside of the box. Facilitate and promote these activities and lobby local companies to develop educational events.
Industry	The results of this Pilot Experience can guide and facilitate the involvement of interested stakeholders in the organisation of competitive events, calls for prizes or other types of non-formaleducational events.
R&D centres/ Universities	
VET Centres	
Secondary schools	

[19] eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018H0604(01)&from=EN
[20] boats4schools.eu/index.php/home-page-2

"I think that what I am learning today will last a lifetime, both in terms of priority management and social relationships of almost any kind. It could help me in many situations."

DAVID DOMÍNGUEZ, Vocational Education Student in Electronic Maintenance

"I learned a lot during this course. Having the template program (of last year's competition winners) as basis is great, because all you have to do is to focus on adjusting the parameters to your own case. I am very pleased with this training."

SAÍNZA ARIAS, Secondary School Technology Teacher

"My expectations of the wood gluing course were to learn how to build the catamaran that we were making for the regatta. The workshop was interesting and fun. Bending vessel planks, gluing, and bonding processes are techniques that I can easily replicate with my students at school. The tools needed are affordable, so I think that building the raft with wood is possible."

JOSE MARÍA CASAL, Secondary Education Visual Arts Teacher

"We are thinking about building the vessel with glass fibre and resins for vessels. MATES workshops encourage us to do a 3D design for the structure of the raft; print the external structure with a 3D printer and coat it with resin tomake it waterproof and lighter. We want to use both technologies: 3D impression and polyester resins."

JUAN PENALTA, Secondary School Technology Teacher

"This MATES experience was well received by the students. So much that we are thinking of repeating and expanding it by scanning the school training ship. In this way, more naval design students of the upcoming years can be involved, making them more actively engaged".

MARTINA VASCOTTO, Naval Architecture teacher

MATES Layman Report – MOL²

All layman reports and education and training materials from all the MATES Pilot Experiences are available on the MATES website and include:

ED2MIT: Education and Training for Data Driven Maritime Industry projectmates.eu/pilotexperience/ed2mit
MOOCs on Industry 4.0 and the naval sector projectmates.eu/pilotexperience/mooc-training-course
Freeboard projectmates.eu/pilotexperience/freeboard
The Magnus Effect projectmates.eu/pilotexperience/the-magnus-effect
Innovation Manager in Shipbuilding Course projectmates.eu/pilotexperience/innovation-manager-course
Additive Manufacturing and Risk Management in the Shipbuilding and Ship Repairs Sectors projectmates.eu/pilotexperience/training-seminar
MOL² Maritime on the Loop of Ocean Literacy projectmates.eu/pilotexperience/mol2
Offshore Renewable Energy Courses projectmates.eu/pilotexperience/renewable-energies-crash-courses
Ocean Pro.Tec Lab projectmates.eu/pilotexperience/ocean-pro-tec-lab
Green Move projectmates.eu/pilotexperience/green-move
Definition of New Occupational Profiles projectmates.eu/pilotexperience/dop-definition-of-new-occupational-profiles

Contact

Lead Author: Dr Susana Bastón, sbaston@cetmar.org
Project Coordinator: Lucía Fraga, lfraga@cetmar.org

projectmates.eu